

INNOVATIVE USE OF UNEXPLOITED DOXYCYCLINE HYDROCHLORIDE TO DYE NYLON

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ABSTRACT

Doxycycline is a synthetic broad-spectrum antibiotic used to treat many different bacterial infections, such as infections of urinary tract, acne, gonorrhea, chlamydiosis, periodontitis (gum disease), blemishes, bumps, and acne-like lesions caused by rosacea.

Taking outdated Doxycycline can cause serious side effects. Therefore outdated Doxycycline hydrochloride drug should be thrown out or discard if there is any leftover. Discarding unused, or expired Doxycycline in the toilet is a common practice. But this method may not be any safer than throwing in the trash, because it still is contaminating water supply.

Deposing of such drugs is a major problem in today's pharmaceutical Industries. In view of this the present study used the unexploited Doxycycline Hydrochloride Drug in textile processing.

Reuse of outdated Doxycycline to dye Nylon by this method can keep unused Doxycycline medication from being illegally abused or sold.

This method can solve two major environmental and economical problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs.

KEYWORDS: Doxycycline, Nylon, Acne, Gonorrhea, Chlamydiosis, Periodontitis, Blemishes, Bumps

INTRODUCTION

Doxycycline is a synthetic broad-spectrum antibiotic used to treat many different bacterial infections, such as infections of urinary tract, acne, gonorrhea, chlamydiosis, periodontitis (gum disease), blemishes, bumps, and acne-like lesions caused by rosacea.

Taking outdated Doxycycline can cause serious side effects. Patients should not take these medicines if:

- The color, appearance, or taste have changed
- The drug has been stored in a warm or damp area
- The expiration date on the label has passed

Therefore outdated Doxycycline drug should be thrown out or discard if there is any leftover. Discarding unused, or expired Doxycycline in the toilet is a common practice. But this method may not be any safer than throwing in the trash, because it still is contaminating water supply.

Therefore, our study was focused on the usage of expired Doxycycline Hydrochloride drug or unused Doxycycline Hydrochloride drug. In our previous study, and Silk, Nylon, Wool and Jute have been successfully dyed with Tetracycline hydrochloride by exhaust process.¹⁻⁴

In this work we made successful attempt to dye Nylon fabric with outdated Doxycycline. This method of unused medicines valorization can solve two major environmental and economical problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs. Collection of unused or outdated Tetracycline can be done by various methods like community take back programs and further can be use to dye Nylon which can keep unused Doxycycline medication from being illegally abused or sold.

MATERIAL AND METHODS

Material

Commercially available ready for dye (RFD) Nylon fabric was used for the study.

Drug Used

Doxycycline Hydrochloride (Trade name -Doxylab), by Laborate Pharmaceutical India Ltd, H.P,

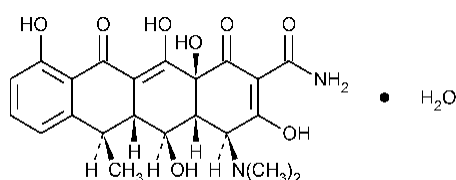


Figure 1



Chemicals

Hydrochloric Acid(HCL) , Ammonium Acetate (CH₃COONH₄), All chemicals are supplied by S.D. Fine Chem. Ltd. and are of AR grade.

METHODS

Dyeing of Nylon

1% stock solution of Tetracycline Hydrochloride was prepared for dyeing. Nylon was dyed with Tetracycline hydrochloride keeping liquor ratio of 20:1, at 100°C for 60 min. Then rinsed and dried.

Colour Measurement

Dyed samples were evaluated for the depth of the colour by determining K/S values using a Spectraflash® SF 300, Computer Colour Matching System supplied by Data color International, U. S. A. An average of four readings taken at four different sample areas was used to calculate the reflectance values, and Kubelka Munk K/S function which is given by:

$$\frac{K}{S} = \frac{(1 - R)^2}{2R}$$

Where,

"R" is the reflectance at complete opacity.

"K" is the absorption coefficient.

"S" is the scattering coefficient.

Tone of the Colour is also measured on the same machine Tone of the Colour in terms of CIE L*a* and b* values.

Washing Fastness was carried out by ISO 105-C01.

Light Fastness was carried out by ISO 105-B02.

Rubbing Fastness was carried out by ISO 105-X12.

RESULTS AND DISCUSSIONS

Drugs lose their potency beyond their expiration date, and therefore their effectiveness and their ability to dissolve can be affected. For patients who rely on medications to stay alive, like heart medications, expired drugs can be dangerous because they may not be getting the full effectiveness of the drug. It depends on the medication.

The present work has used Doxycycline hydrochloride an antibiotic for dyeing of Nylon fabric. At the outset the Nylon fabric was dyed at 100°C for 60 min and the concentration was varied between 0.5% to 3% and the results are shown in Table 1 and Figure 1, 2, and 3.

Table 1: Colorant Strength Calculation Values of Nylon Substrate Dyed with Doxycycline Hydrochloride

Sr. No.	TCH Conc. %	L*	A*	B*	C*	H*	K/S
1	0.5	63.686	3.571	15.352	15.762	76.874	0.5321
2	1	63.941	3.412	15.778	16.143	77.766	0.7009
3	2	64.135	2.568	15.805	16.012	80.739	1.4904
4	3	64.249	-0.318	22.299	22.301	90.853	2.4116

Table 2: Fastness Properties of Nylon Substrate Dyed with Doxycycline

Sr. No.	TCH	Washing Fastness	Light Fastness	Rubbing Fastness	
	%Shade			Dry	Wet
1	0.5%	3-4	4	3-4	3-4
2	1%	3-4	4	3-4	3-4
3	2%	3-4	4	3-4	3-4

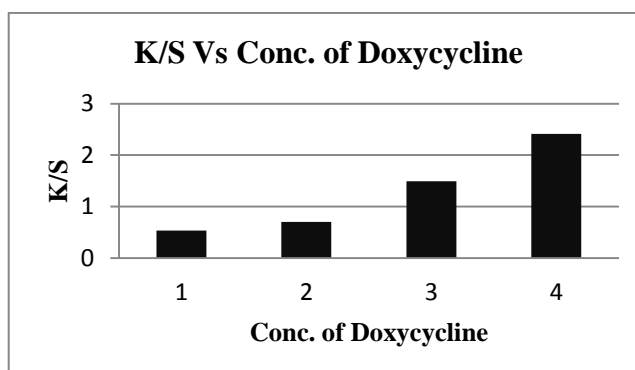


Figure 1: K/S vs Concentration of Tetracycline Hydrochloride in %

The Doxycycline drug is light-yellow in color. On varying the concentration of Doxycycline solution used for dyeing a wide range of shade of color was obtained. Table 1 indicates that as the L value increases 0.5 % to 3% and hence the lightness increases and become maximum at 3%, hence as the concentration of Doxycycline increases the lightness

characteristic increases. The value of a^* found to be decreasing from 0.5% to 3% as the concentration increases. Hence it can be observed that as the concentration increases the greenness characteristics increase and become maximum at 3%. The value of b^* increases from 0.5% to 3% and becomes maximum yellower at 3% which indicates that yellowness increases as increase in % shade and its maximum at 3%. From the table 1 and Figure 1 it has been observed that the K/S with increase in concentration increases and maximum at 3%. Thus Doxycycline drug can be used to dye Nylon fabric by the exhaust process. The light fastness as seen in table 2 is good. At % concentration the hue became maximum greener and yellower which can be observed by the value of Chroma C^* and hue H^* indicated by table 1. The successful dyeing of Nylon by using a drug which has expired potency for human consumption can be recycled to dye the Nylon fabric instead of polluting the effluent and the whole process is environmental friendly and a very good alternative for the use of the expired Doxycycline drug. The End-use can be in various sectors in apparels, kid's garments, technical textile, medical textile etc.

CONCLUSIONS

Doxycycline is a common antibiotic and waste of expired drugs contributes to a large extent. Thus the above project throws an innovative light of using the unexploited Doxycycline drugs in textile processing especially in dyeing of Nylon. The above experimentation has exhibited the uniform level dyeing of Nylon can be achieved by using expired Doxycycline for dyeing of Nylon with a wide gamut of colors with increasing concentration.

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